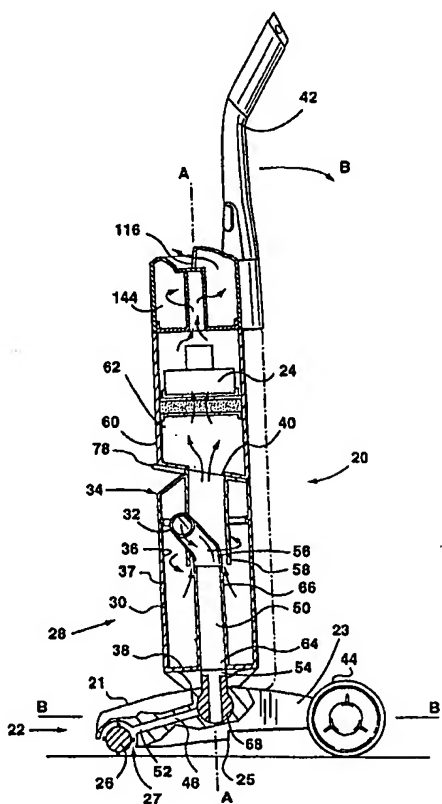


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| (54) Title: UPRIGHT VACUUM CLEANER | | | |
| (57) Abstract <p>An upright vacuum cleaner (20) wherein the motor (24) is positioned above the cyclone separation device (28). A construction for a cleaning head (22) of a vacuum cleaner is also provided such that the vacuum cleaner is reconfigurable to a lowered storage position in which the upper body portion (120) of the vacuum cleaner extends rearwardly from the cleaning head (22) of the vacuum cleaner.</p> | | | |
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- 1 -

Title: UPRIGHT VACUUM CLEANER**FIELD OF THE INVENTION**

The present invention relates generally to upright vacuum cleaners. In one particular application, the invention relates to an upright vacuum cleaner which uses the cyclonic separation of dirt from an air flow as the primary dirt separation mechanism.

BACKGROUND OF THE INVENTION

Various types of vacuum cleaners are traditionally produced. These include built in vacuum cleaners, canister vacuum cleaners and upright vacuum cleaners. Upright vacuum cleaners have a ground engaging portion and an upwardly extending portion. The ground engaging portion typically has wheels for movement of the cleaning head across a floor and a suction inlet for the intake of dirty air into the vacuum cleaner. The upwardly extending portion comprises the filter means for removing dirt which is entrained in the air. The upwardly extending portion generally has a handle for guiding the vacuum cleaner across the floor.

Traditionally in upright vacuum cleaners, the motor to draw the dirty air through the vacuum cleaner is positioned in the ground engaging head and the upward extending portion is pivotally mounted to the upper portion of the ground engaging member at a position adjacent the motor.

The advantages of cyclonic separation have been combined with an upright vacuum cleaner to provide a household cyclonic vacuum cleaner, as shown in U.S. Patent No. 4,593,429 to Dyson.

Upright vacuum cleaners comprise a large segment of the vacuum cleaner market. Unfortunately, they are typically difficult to store. For example, the vacuum cleaner is generally stored with the upper body portion extending generally vertically from the vacuum cleaner head. In this upper storage position, the storage space which is required for the

- 2 -

vacuum cleaner comprises the sum of the footprint of the vacuum cleaner as well as the additional space required to accommodate the upper body portion which is positioned at the rear of the vacuum cleaner head.

SUMMARY OF THE INVENTION

5 In accordance with the instant invention, a vacuum cleaner head having a novel configuration is provided. The vacuum cleaner head has rear wheel mounts which are spaced apart a sufficient amount so as to allow the upper body portion of an upright vacuum cleaner to be positioned there between so as to enable the vacuum cleaner to lie flat.
10 Thus, the vacuum cleaner has a very low profile and may be able to be stored, for example, under a bed. Further, by enabling the upper body portion to extend directly behind the vacuum cleaner head, the vacuum cleaner may be hung in a closet or the like with a minimum of storage space being occupied by the vacuum cleaner.

15 An advantage of this invention is that the back pressure created by the flow of air through the vacuum cleaner is reduced thus enabling a smaller and lighter motor to be utilized to produce the same air flow rate through the vacuum cleaner. An advantage of the use of a smaller motor is that the noise generated by the vacuum cleaner during
20 operation is reduced.

 In accordance with the instant invention, there is provided an upright vacuum cleaner comprising a cleaning head for cleaning a surface; an upper body portion mounted on the cleaning head, the upper portion having a longitudinally extending axis and comprising at least one
25 cyclone having an air entry port; and a motor positioned above the at least one cyclone and in air flow communication with the at least one cyclone.

 In one embodiment, the cleaning head has a forward portion including an opening in air flow communication with the at least one cyclone and two spaced apart rear portions extending rearwardly from the
30 forward portion, the spaced apart rear portions defining an open space there between, the upper body portion mounted on the cleaning head at a

- 3 -

position forward of the spaced apart rear portions. The upper portion is positionable in a lowered in use position wherein the longitudinally extending axis is at an angle of 40° to the vertical and, when the upper body portion is in the lowered in use position, the centre of gravity of the upper body portion is preferably positioned above the open space.

In another embodiment, the upper body portion further comprises a handle, the weight of the handle in the lowered in use position being 2 lbs. or less.

In another embodiment, the spaced apart rear members have floor contacting members adjacent the ends thereof.

In another embodiment, the cleaning head has a forward portion including an opening in air flow communication with the at least one cyclone and two spaced apart rear wheels extending rearwardly from the forward portion, the upper body portion mounted on the cleaning head at a position forward of the rear wheels, and when the longitudinally extending axis is at an angle of 40° to the vertical, the centre of gravity is positioned forward of the rear wheels.

In another embodiment, the upper body portion is pivotally connected to the cleaning head whereby the upper body portion is moveable between an in use position in which the upper body portion extends upwardly and rearwardly from the cleaning head and a lowered storage position in which the upper body portion extends generally rearwardly from the cleaning head.

In another embodiment, the cleaning head has a forward portion and two spaced apart rear portions extending rearwardly from the forward portion, the upper body portion mounted on the cleaning head at a position forward of the spaced apart rear portions, the spaced apart rear portions defining an open space there between sized for receiving a portion of the upper body portion there between when the upper body portion is in the lowered storage position.

In another embodiment, the vacuum cleaner further comprises a mounting member engageable with a support member

- 4 -

mounted on a wall whereby the vacuum cleaner may be hung flush against the wall when the upper body portion is in a lowered storage position.

5 In another embodiment, the vacuum cleaner further comprises a second cleaning member positioned downstream from the at least one cyclone.

In another embodiment, the vacuum cleaner further comprises an air outlet to the at least one cyclone for passage there through of air, the air passing generally upwardly from the air outlet to the motor.

10 In another embodiment, the second cleaning member is an electrostatic cleaning member and/or at least one second cyclone. The second cleaning member may be positioned between the at least one cyclone and the motor. The second cleaning member may comprise a plurality of second cyclones.

15 In another embodiment, the second cleaning member is positioned between the at least one cyclone and the motor, the vacuum cleaner further comprising an air outlet to the at least one cyclone and an air outlet to each of the at least one second cyclones, the air passing generally upwardly from the air outlet to the at least one cyclone to the at least one second cyclones and generally upwardly from the air outlet to the at least one second cyclones to the motor.

20 In another embodiment, the second cleaning member comprises at least one second cyclone positioned downstream of the motor, the vacuum cleaner further comprising an air outlet to the at least one cyclone, the air passing generally upwardly from the air outlet to the at least one cyclone to the motor and generally upwardly from motor to the at least one second cyclone.

25 In accordance with another aspect of the instant invention, there is also provided an upright vacuum cleaner comprising a vacuum cleaner head for cleaning a floor having a forward portion and two spaced apart rear portions extending rearwardly from the forward portion, the spaced apart rear portions defining an open space there between; and, a

30

- 5 -

longitudinally extending upper body portion having a longitudinal axis, the upper body portion being pivotally mounted on the vacuum cleaner head and moveable between a raised position and a lowered position in which the longitudinal axis is generally parallel to the floor, a portion of
5 the upper body portion being received in the open space between the rear portions when in the lowered storage position.

In one embodiment, the upper body portion is pivotally mounted on the vacuum cleaner head at a position forward of the spaced apart rear portions.

10 In another embodiment, the upper body portion includes a dirt separation member and a handle.

In another embodiment the forward portion has a rearward surface and the rear portions extend rearwardly of the rearward surface.

In another embodiment, the upright vacuum cleaner further
15 comprises front wheels positioned on the forward portion and rear wheels positioned on the rear portions. Each rear portion may have a rearward end and rear wheels are positioned adjacent the rearward end of rear portions.

In another embodiment, the upright vacuum cleaner further
20 comprises a front and spaced apart lateral sides extending longitudinally from the front towards the rear portions and the rear portions extend rearwardly from a position adjacent the lateral sides.

In another embodiment, the upright vacuum cleaner further comprises dirt separation means and a portion of the upper body portion
25 containing a portion of the dirt separation means is positioned forward of the rear wheels when the upper body portion is positioned in the lowered storage position.

In accordance with another aspect of the instant invention, there is also provided a vacuum cleaner head adapted for connection to a
30 longitudinally extending upper body portion defining an upper body axis, the vacuum cleaner head comprising a main portion defining a vacuum cleaner head axis, rear wheel mount portions positioned rearward of the

- 6 -

main portion and a passage for receiving a portion of the upper body portion; and a pivot member for pivotally mounting the upper body portion to the vacuum cleaner head for movement of the upper body portion between a raised position in which the upper body axis is at an angle to the vacuum cleaner head axis and a lowered storage position in which the upper body axis and the vacuum cleaner head axis are substantially parallel.

In one embodiment, the pivot member is mounted on the vacuum cleaner head at a position forward of the rear wheel mount portions.

In another embodiment, the upper body portion includes a dirt separation member and a handle and the passage is sized to receive therein a portion of the upper body portion including the dirt separation member.

In another embodiment, the rear wheel mount portions are positioned on either side of the passage. Each rear wheel mount portion may have a rearward end and rear wheels are positioned adjacent the rearward end of rear wheel mount portions.

In accordance with another aspect of the instant invention, there is also provided a vacuum cleaner head adapted for connection to a longitudinally extending upper body portion defining an upper body axis, the vacuum cleaner head comprising a main portion defining a vacuum cleaner head axis, rear wheel mount means positioned rearward of the main portion and storage means extending in the direction of the vacuum cleaner head axis for receiving a portion of the upper body portion; and pivot means for pivotally mounting the upper body portion to the vacuum cleaner head for movement of the upper body portion between a raised position in which the upper body axis is at an angle to the vacuum cleaner head axis and a lowered storage position in which the upper body portion is received in the storage means.

In one embodiment, the pivot means is mounted on the vacuum cleaner head at a position forward of the rear wheel mount

- 7 -

means.

In another embodiment, the upper body portion includes a dirt separation member and the storage means is sized to receive therein a portion of the upper body portion including the dirt separation member.

- 5 The rear wheel mount means are preferably positioned on either side of the storage means. Each rear wheel mount means preferably has a rearward end and rear wheels are positioned adjacent the rearward end of rear wheel mount means.

BRIEF DESCRIPTION OF THE DRAWINGS

- 10 For a better understanding of the present invention, and to show more clearly how it may be carried into effect, reference will now be made by way of example to the accompanying drawing which show a preferred embodiment of the present invention, in which:

- 15 Figure 1 is a perspective view of an upright vacuum cleaner according to the instant invention;

Figure 1 is a cross-section along line 3 - 3 in Figure 1 of an alternate preferred embodiment of an upright cyclonic vacuum cleaner with an air intake conduit according to the present invention;

- 20 Figure 4 is a side elevational view of the upright vacuum cleaner of Figure 1 wherein the housing has been rotated rearwardly;

Figure 4 is a side elevational view of the upright vacuum cleaner of Figure 1 wherein the housing has been rotated rearwardly to the lowered storage position;

- 25 Figure 5 is an enlargement of a portion of the cross section of the housing of the vacuum cleaner of Figure 2 showing a second cyclonic filtration stage; and,

Figure 6 is a cross-section along line 5-5 in Figure 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

- 30 The following description of improvements in cyclone separators is described in their use with a vacuum cleaner and in

- 8 -

particular an upright vacuum cleaner. It will be appreciated that the improvements in upright vacuum cleaners may be used with vacuum cleaners having any filtration means known in the art but are preferably used in upright vacuum cleaners using cyclonic separation as part or all of the dirt filtration system.

An upright cyclonic vacuum 20 according to the present invention is shown in the Figures 1 and 2. The motor is positioned in the upper body portion of the vacuum cleaner.

Referring to Figures 1 and 2, vacuum cleaner 20 has a floor cleaning head 22, means for moving cleaning head 22 across a floor (eg. wheels 44 which may comprise rear wheels or front and rear wheels), a housing 60 rotatably attached to cleaner head 22, and a handle 42 for moving cleaner 20 across the floor. In this embodiment, cleaning head 22 comprises a forward portion 21 and two rear portions 23 extending rearwardly from the forward portion 21. Rear portions 23 are spaced apart and define a space 118 there between. A valve means 68 (eg. a rotatable valve as is known in the art) is provided in cleaning head 22 so as to connect downstream portion 50 of air conduit 46 in air flow communication with upstream portion 48 of air conduit 46 when housing 60 is rotated rearwardly in the direction of arrow B to the position shown in Figure 3 in which position vacuum cleaner 20 is configured for use for cleaning a floor.

Housing 60 houses at least one cyclone separator. In this embodiment, cyclonic separator unit 28 uses one cyclone separator, namely container or cyclone bin 30. Cyclonic unit 28 may comprise any type of dirt separation cyclone known in the art, e.g. cylindrical or frusto-conical, and may comprise a single stage cyclone or multiple stage cyclone (either in series and/or in parallel). It will be appreciated that a second stage filtration means, which may comprise a single stage cyclone or multiple stage cyclone (either in series and/or in parallel), may be positioned downstream from container 30 such as in cavity 62. If the second stage filtration means comprises a plurality of cyclones, then the second stage

cyclones are preferably in parallel. The treated air travels upwardly from clean air outlet 40 to motor 24 either directly or through the secondary filtration stage which may optionally be positioned in cavity 62. The cleaned air may then exit housing 60 via outlet 116 or it may first
5 optionally pass through chamber 144, which may contain a further filtration means, or the secondary cleaning stage if such is not positioned prior to motor 24, (eg. a HEPA™ filter).

Cyclonic unit 28 comprises at least a first cyclone container or bin 30 having an air inlet 56, preferably at upper end 34 thereof, adapted for
10 providing an air flow tangentially to an inner dirt rotation surface 36 of container 30. Air inlet 56 may be configured to provide an axial flow of air to container 30 and opening 32 at the downstream end of air inlet 56 may have vanes to impart cyclonic flow to the air stream. Preferably, inlet 56 is configured to introduce the air tangentially to container 30 as shown in
15 Figure 2. Container 30 also has a dirt collection surface or bottom 38 and a clean air outlet 40.

The air flow path through cleaner 20 commences with an air supply conduit 46 having an upstream portion 48 and a downstream portion 50. Upstream portion 48 is provided in head 22 and has a first end
20 52 positioned adjacent brush member 26 or the like for receiving the dirt laden air and a distal second end 54. Downstream portion 50 has a upstream end 64 which is positioned in air flow communication with second end 54 and a downstream end 66. Preferably ends 54 and 64 are substantially sealed together to prevent air and dirt leaking there from.
25 Downstream portion 50 may extend upwardly through container 30. Alternately, downstream portion 50 may extend upwardly at a position adjacent outer surface 37 of container 30.

In one embodiment, upstream and downstream portions 48, 50 may comprise a single member (whether integrally formed or
30 connected together to form a continuous flow path). In such a case, a separated dirt collection means may be positioned below container 30 or portions 48, 50 may be flexible so as to allow cyclone container 30 to be

- 10 -

removed from housing 60 and emptied. In another embodiment, upstream and downstream portions 48, 50 are separate elements and downstream portion 50 is removable with container 30 from housing 60 such that portions 48, 50 are in air flow communication when container 30 is mounted in housing 60 of vacuum cleaner 20. Thus, if a blockage develops in conduit 46, by removing container 30 from housing 60, portions 48 and 50 may be individually accessed at ends 54 and 64 to clean out the blockage.

Air inlet 56 is positioned at the upper end of downstream portion 50. Opening 32 is positioned at the distal end of air inlet 56 from end 66 of downstream portion 50. Air inlet 56 defines the exit portion of the air supply conduit extending longitudinally with the cyclone and may extend along any desired path from downstream portion 50 to opening 32. Preferably, air inlet 56 is wholly positioned within container 30 (eg. it does not exit or enter the container 30 through upper end 34).

It will be appreciated that opening 32 may be any inlet known in the cyclonic art to introduce air into a cyclone and it may be positioned at any point along the longitudinal length of container 30 as is known in the cyclonic art.

Referring to Figures 5 and 6 a second cyclonic stage 130. In this embodiment, second filtration stage 130 comprises three second cyclones 132. Second cyclones 132 may be the same or different and may of any particular configuration known in the art. Second filtration stage 132 also comprises a conduit 134 in fluid flow communication with outlet 40 from the first cyclonic stage 28. Conduit 134 is in air flow communication with inlets 136 to second stage cyclones 132. The partially cleaned air is introduced tangentially into second stage cyclones 132 and travels downwardly there through with the separated dirt exiting second cyclones 132 via dirt outlets 138. The further cleaned air travels upwardly through the central portion of second cyclones 132 to air outlets 140.

The air may travel directly to motor 24 or may pass through a screen or filter 142 which is positioned between second filtration stage 130

- 11 -

and motor 24. The cleaned air travelling by motor 24 cools the motor.

In operation, the vacuum fan motor 24 is activated to induce an air flow through cleaner 20. The air flow causes a partial vacuum to form at end 52. Air, and entrained dirt, is drawn into upstream portion 48, with the aid of brush member 26. The dirty air flow moves vertically in downstream portion 50 to opening 32 in air inlet 56 and is introduced tangentially to container 30. The airflow is then accelerated around dirt rotation surface 36, and proceeds generally downwardly along and around dirt rotation surface 36 until it reaches a position towards bottom 38 of container 30, at which point the air flow travels upwardly through the central portion of cyclone container 30. Wall 58 may provide an extension of outlet 40 in container 30. Wall 58 assists in preventing the treated air travelling upwardly to outlet 40 from mixing with the dirty air which is introduced into container 30 via inlet 56.

In the embodiment of Figure 2, it will be appreciated that from second end 54, the dirty air travels upwardly through the filtration stages and exits the vacuum cleaner at the top. In particular, the air travels upwardly to air inlet 56 to cyclonic unit 28. The air then travels upwardly from air outlet 40 to the motor, optionally passing first through a further filtration stage positioned in cavity 62 and, if desired, further upwardly to a further filtration stage (eg. a HEPA™ filter) which may be positioned in chamber 114 which is provided in housing 60 above motor 24. Regardless of the sequence of the filtration stages, or their number, the air continues to travel generally upwardly from one stage to the next preferably without 90° elbows being required to direct the air flow.

Housing 60 is pivotally mounted to cleaning head 22 such as by a ball joint or a pivotal valve 68 as shown in Figure 2. Accordingly, the housing may be positionable in an upright storage position as shown in Figure 1 wherein housing 60 extends generally vertically upwardly from cleaning head 22. Housing 60 may be lockingly positioned in this position by any locking means as is known in the art. Housing 60 is preferably mounted to cleaning head 22 at a position forward of rear portions 23 and

- 12 -

more preferably on front portion 21. Cleaning head 22 is preferably configured given the vertical position of motor 24 in housing 60 such that when housing 60 is at an angle α of about 40° to the vertical as shown in Figure 3, then the centre of gravity of housing 60 is positioned in front of wheels 44 and, more preferably, above space 118.

In a particularly preferred embodiment, upper body portion 120 is positionable in a lowered storage position wherein upper body portion 120 extends generally rearwardly from front portion 21 of cleaning head 22 (see Figure 4). Preferably, a space 118 is provided and has a sufficient width so as to accommodate therein the lower portion of upper body portion 120. Thus rear portions 23 extend on either side of upper body portion when upper body portion 120 is in the lowered storage position so as to allow the vacuum cleaner to lie effectively flat. Preferably, space 118 has a sufficient width so as to allow upper body portion 120 to fit there within so that vacuum cleaner head axis B is generally parallel to main body axis A of upper body portion 29 (eg., axis A may be at an angle of $5 - 10^\circ$ to axis B and, preferably, axis A is at an angle of 0° to axis B as is shown in Figure 4). More preferably, longitudinal axis A and B define a continuous axis when upper body portion 29 is the lowered storage position.

If the portion of conduit 48 extending from valve 68 to bottom 38 is sufficiently long, upper body portion 120 may be positionable in the lowered storage position such that bottom 38 is spaced rearward from rearward ends 122 of rear portions 23 so that it may lie flat even if no space 118 is provided. With this profile, vacuum cleaner 20 may be easily placed under many beds and like pieces of furniture for storage or cleaning. Further, it may be hung for storage such as from a hook mounted in a wall or from a ceiling by means of hanger 124 using any hanger means known in the art (see Figure 4).

Despite having motor 24 positioned in the upper portion of upper body portion 120, only a small amount of force may be required to hold vacuum cleaner 20 in the in use position as shown in Figure 4. For

- 13 -

example, when housing 60 is inclined such that axis A is at an angle α of 40° to the vertical (see Figure 4), the weight exerted by handle 42 in the hand of a user may be less than three pounds and, preferably, is less than two pounds. Accordingly, the vacuum cleaner provides ease of use despite
5 the position of motor 24 in housing 60.

Therefore, the configuration of the air path through the vacuum cleaner according to the present invention advantageously permits a substantial reduction in the pressure loss produced by the flow of air through the vacuum cleaner without interfering with the overall
10 performance of the cyclone separation device. Thus, the present invention permits a smaller motor to be used to provide a similar draw at the intake end 52 compared to current designs.

While the above description constitutes the preferred embodiments, it will be appreciated that the present invention is
15 susceptible to modification and change without departing from the fair meaning of the proper scope of the accompanying claims.

It will be appreciated by those skilled in the art that various additions and modifications may be made to the instant invention and all of these are within scope of the following claims. For example, the
20 dimensioning of the cleaning head and the upper body portion of the vacuum cleaner may be used with a vacuum cleaner having any particular filtration means (eg. including a typical dust bag) and with the motor positioned at any point in the vacuum cleaner (eg. in the cleaning head).

- 14 -

We Claim:

1. An upright vacuum cleaner comprising:
 - (a) a cleaning head for cleaning a surface;
 - (b) an upper body portion mounted on the cleaning head, the
5 upper portion having a longitudinally extending axis and
comprising:
 - (i) at least one cyclone having an air entry port; and,
 - (ii) a motor positioned above the at least one cyclone
and in air flow communication with the at least one
10 cyclone.
2. The vacuum cleaner as claimed in claim 1 wherein the
cleaning head has a forward portion including an opening in air flow
communication with the at least one cyclone and two spaced apart rear
portions extending rearwardly from the forward portion, the spaced apart
15 rear portions defining an open space there between, the upper body
portion mounted on the cleaning head at a position forward of the spaced
apart rear portions.
3. The vacuum cleaner as claimed in claim 2 wherein the upper
portion is positionable in a lowered in use position wherein the
20 longitudinally extending axis is at an angle of 40° to the vertical and, when
the upper body portion is in the lowered in use position, the centre of
gravity of the upper body portion is positioned above the open space.
4. The vacuum cleaner as claimed in claim 3 wherein the upper
body portion further comprises a handle, the weight of the handle in the
25 lowered in use position being 3 lbs. or less.
5. The vacuum cleaner as claimed in claim 3 wherein the
spaced apart rear members have floor contacting members adjacent the

- 15 -

ends thereof.

6. The vacuum cleaner as claimed in claim 1 wherein the cleaning head has a forward portion including an opening in air flow communication with the at least one cyclone and two spaced apart rear wheels extending rearwardly from the forward portion, the upper body portion mounted on the cleaning head at a position forward of the rear wheels, and when the longitudinally extending axis is at an angle of 40° to the vertical, the centre of gravity is positioned forward of the rear wheels.

7. The vacuum cleaner as claimed in claim 1 wherein the upper body portion is pivotally connected to the cleaning head whereby the upper body portion is moveable between an in use position in which the upper body portion extends upwardly and rearwardly from the cleaning head and a lowered storage position in which the upper body portion extends generally rearwardly from the cleaning head.

8. The vacuum cleaner as claimed in claim 7 wherein the cleaning head has a forward portion and two spaced apart rear portions extending rearwardly from the forward portion, the upper body portion mounted on the cleaning head at a position forward of the spaced apart rear portions, the spaced apart rear portions defining an open space there between sized for receiving a portion of the upper body portion there between when the upper body portion is in the lowered storage position.

9. The vacuum cleaner as claimed in claim 1 wherein the upper body portion further comprises a handle, the weight of the handle in a lowered in use position being 2 lbs. or less.

10. The vacuum cleaner as claimed in claim 1 further comprising a mounting member engageable with a support member mounted on a wall whereby the vacuum cleaner may be hung flush against the wall

- 16 -

when the upper body portion is in a lowered storage position.

11. The vacuum cleaner as claimed in claim 1 further comprising a second cleaning member positioned downstream from the at least one cyclone.

5 12. The vacuum cleaner as claimed in claim 1 further comprising an air outlet to the at least one cyclone for passage there through of air, the air passing generally upwardly from the air outlet to the motor.

13. The vacuum cleaner as claimed in claim 11 wherein the second cleaning member is an electrostatic cleaning member.

10 14. The vacuum cleaner as claimed in claim 11 wherein the second cleaning member is positioned between the at least one cyclone and the motor.

15. The vacuum cleaner as claimed in claim 11 wherein the second cleaning member comprises at least one second cyclone.

15 16. The vacuum cleaner as claimed in claim 11 wherein the second cleaning member comprises a plurality of second cyclones.

17. The vacuum cleaner as claimed in claim 16 wherein the second cleaning member is positioned between the at least one cyclone and the motor, the vacuum cleaner further comprising an air outlet to the at least
20 one cyclone and an air outlet to each of the at least one second cyclones, the air passing generally upwardly from the air outlet to the at least one cyclone to the at least one second cyclones and generally upwardly from the air outlet to the at least one second cyclones to the motor.

18. The vacuum cleaner as claimed in claim 15 wherein the second

- 17 -

cleaning member is positioned downstream of the motor, the vacuum cleaner further comprising an air outlet to the at least one cyclone, the air passing generally upwardly from the air outlet to the at least one cyclone to the motor and generally upwardly from motor to the at least one second
5 cyclone.

19. An upright vacuum cleaner comprising:

- 10 (a) a vacuum cleaner head for cleaning a floor having a forward portion and two spaced apart rear portions extending rearwardly from the forward portion, the spaced apart rear portions defining an open space there between; and,
- 15 (b) a longitudinally extending upper body portion having a longitudinal axis, the upper body portion being pivotally mounted on the vacuum cleaner head and moveable between a raised position and a lowered position in which the longitudinal axis is generally parallel to the floor, a portion of the upper body portion being received in the open space between the rear portions when in the lowered storage position.

20 20. The upright vacuum cleaner as claimed in claim 19 wherein the upper body portion is pivotally mounted on the vacuum cleaner head at a position forward of the spaced apart rear portions.

21. The upright vacuum cleaner as claimed in claim 19 wherein the upper body portion includes a dirt separation member and a handle.

25 22. The upright vacuum cleaner as claimed in claim 19 wherein the forward portion has a rearward surface and the rear portions extend rearwardly of the rearward surface.

23. The upright vacuum cleaner as claimed in claim 19 further comprising

- 18 -

front wheels positioned on the forward portion and rear wheels positioned on the rear portions.

24. The upright vacuum cleaner as claimed in claim 23 wherein each rear portion has a rearward end and rear wheels are positioned adjacent the rearward end of rear portions.

25. The upright vacuum cleaner as claimed in claim 19 further comprises a front and spaced apart lateral sides extending longitudinally from the front towards the rear portions and the rear portions extend rearwardly from a position adjacent the lateral sides.

26. The upright vacuum cleaner as claimed in claim 19 further comprising dirt separation means and a portion of the upper body portion containing a portion of the dirt separation means is positioned forward of the rear wheels when the upper body portion is positioned in the lowered storage position.

27. A vacuum cleaner head adapted for connection to a longitudinally extending upper body portion defining an upper body axis, the vacuum cleaner head comprising:

- (a) a main portion defining a vacuum cleaner head axis, rear wheel mount portions positioned rearward of the main portion and a passage for receiving a portion of the upper body portion; and,
- (b) a pivot member for pivotally mounting the upper body portion to the vacuum cleaner head for movement of the upper body portion between a raised position in which the upper body axis is at an angle to the vacuum cleaner head axis and a lowered storage position in which the upper body axis and the vacuum cleaner head axis are substantially parallel.

- 19 -

28. The vacuum cleaner head as claimed in claim 27 wherein the pivot member is mounted on the vacuum cleaner head at a position forward of the rear wheel mount portions.

29. The vacuum cleaner head as claimed in claim 28 wherein the upper
5 body portion includes a dirt separation member and a handle and the passage is sized to receive therein a portion of the upper body portion including the dirt separation member.

30. The vacuum cleaner head as claimed in claim 27 wherein the rear wheel mount portions are positioned on either side of the passage.

10 31. The vacuum cleaner head as claimed in claim 30 wherein each rear wheel mount portion has a rearward end and rear wheels are positioned adjacent the rearward end of rear wheel mount portions.

32. The vacuum cleaner head as claimed in claim 27 further comprises a front and spaced apart lateral sides extending longitudinally from the front
15 towards the rear wheel mount portions and the rear wheel mount portions extend rearwardly from a position adjacent the lateral sides.

33. A vacuum cleaner head adapted for connection to a longitudinally extending upper body portion defining an upper body axis, the vacuum cleaner head comprising:

- 20 (a) a main portion defining a vacuum cleaner head axis, rear wheel mount means positioned rearward of the main portion and storage means extending in the direction of the vacuum cleaner head axis for receiving a portion of the upper body portion; and,
- 25 (b) pivot means for pivotally mounting the upper body portion to the vacuum cleaner head for movement of the upper body portion between a raised position in which the

- 20 -

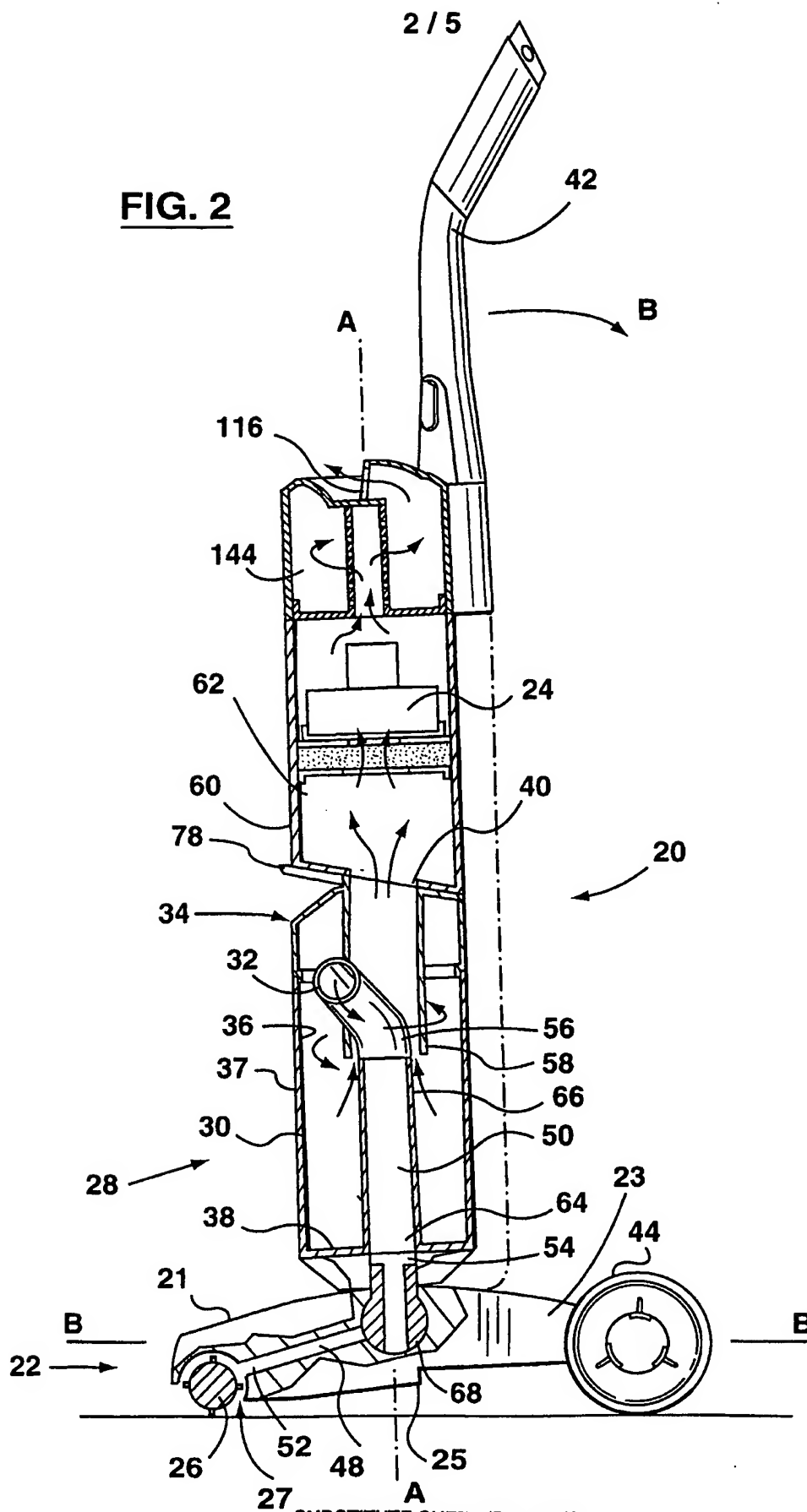
upper body axis is at an angle to the vacuum cleaner head axis and a lowered storage position in which the upper body portion is received in the storage means.

34. The vacuum cleaner head as claimed in claim 33 wherein the pivot
5 means is mounted on the vacuum cleaner head at a position forward of the rear wheel mount means.

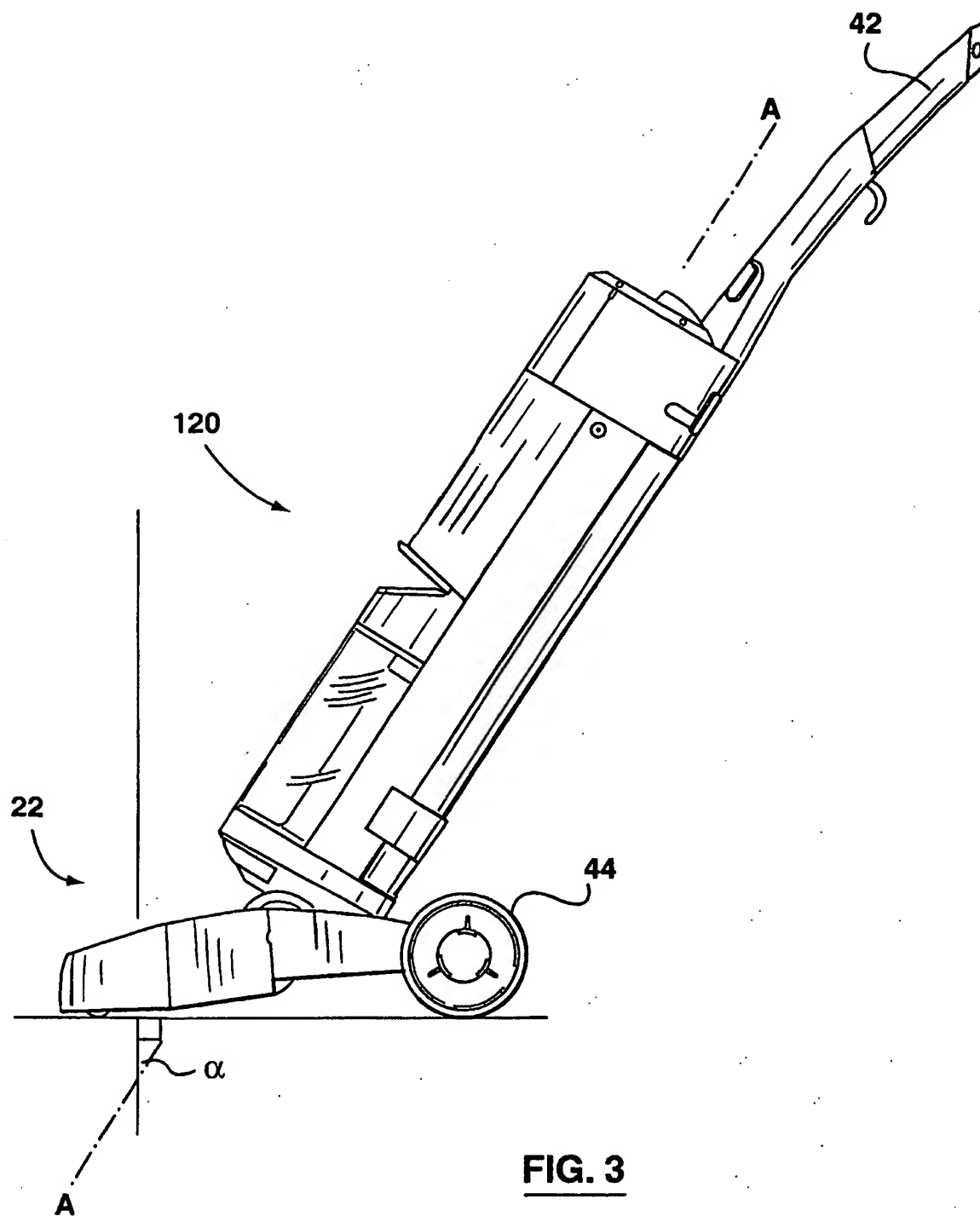
35. The vacuum cleaner head as claimed in claim 33 wherein the upper
body portion includes a dirt separation member and the storage means is
sized to receive therein a portion of the upper body portion including the
10 dirt separation member.

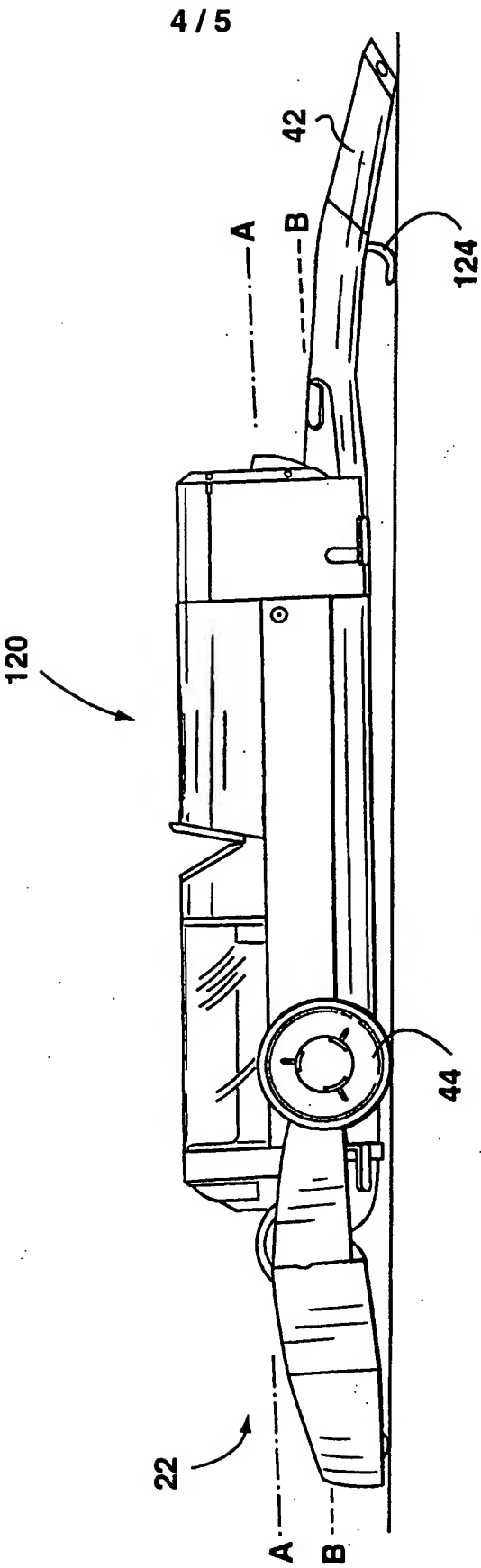
36. The vacuum cleaner head as claimed in claim 33 wherein the rear
wheel mount means are positioned on either side of the storage means.

37. The vacuum cleaner head as claimed in claim 36 wherein each rear
wheel mount means has a rearward end and rear wheels are positioned
15 adjacent the rearward end of rear wheel mount means.



3 / 5

**FIG. 3**



5 / 5

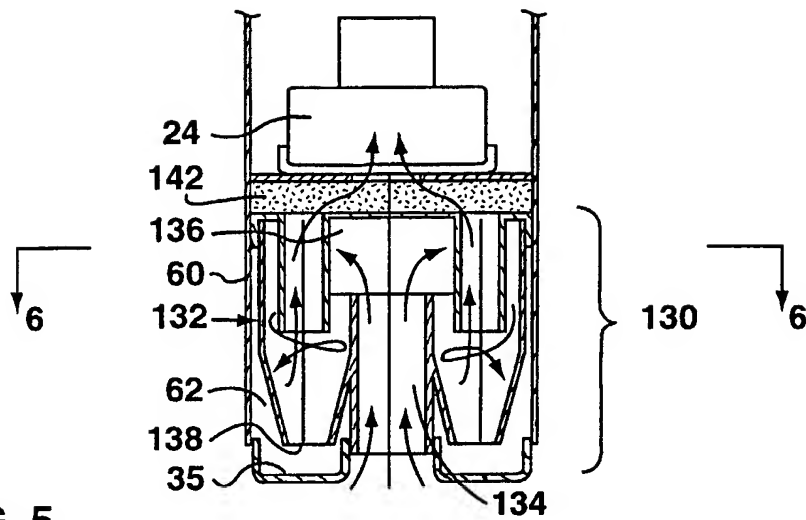


FIG. 5

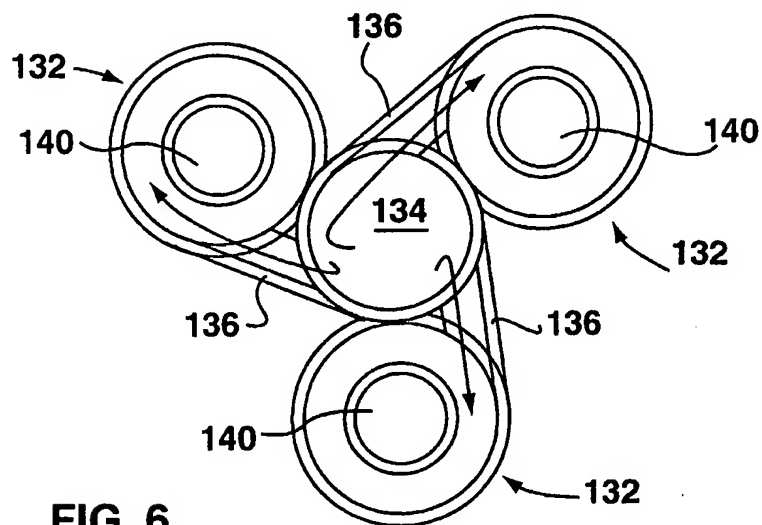


FIG. 6

INTERNATIONAL SEARCH REPORT

In national Application No

PCT/CA 00/00018

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A47L9/16 A47L5/28 A47L9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A47L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|---------------------------------------|
| X | FR 1 094 603 A (MARTELLIERE F) 23 May 1955 (1955-05-23) the whole document | 1 |
| Y | --- | 2, 7, 8, 11, 12, 14 |
| Y | US 2 300 266 A (SMELLIE D G) 27 October 1942 (1942-10-27) page 1, column 2, line 8 - line 27 figures 1-3 | 2, 7, 8, 11, 12, 14 |
| X | --- | 19-25, 27, 28, 30-34, 36, 37 |
| X | WO 95 16382 A (RACINE INDUSTRIES, INC) 22 June 1995 (1995-06-22) figures 1, 3 | 1 |
| | --- -/-- | |

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Date of the actual completion of the international search

20 April 2000

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|----------|---|---|
| X | <p>US 1 937 765 A (LEATHERS W) 5 December 1933 (1933-12-05)</p> <p>page 1, line 30 - line 63 page 1, line 86 - line 89 figures 1,2</p> <p style="text-align: center;">---</p> | <p>19-22, 25,27, 28, 30-34, 36,37</p> |
| A | <p>US 4 593 429 A (DYSON J) 10 June 1986 (1986-06-10) cited in the application abstract; figures</p> <p style="text-align: center;">---</p> | <p>1,15,16, 19,27,33</p> |
| A | <p>US 2 267 764 A (TAYLOR C H) 30 December 1941 (1941-12-30) page 1, column 2, line 29 - line 40 page 5, column 1, line 20 -column 2, line 1 figures</p> <p style="text-align: center;">---</p> | <p>3-6</p> |
| A | <p>EP 0 839 489 A (AEG HAUSGERAETE GMBH) 6 May 1998 (1998-05-06) abstract column 1, line 42 -column 2, line 22 figures</p> <p style="text-align: center;">---</p> | <p>10</p> |
| A | <p>US 2 595 752 A (BATTS C C) 6 May 1952 (1952-05-06) the whole document</p> <p style="text-align: center;">---</p> | <p>10</p> |
| A | <p>EP 0 815 788 A (CANDY SPA) 7 January 1998 (1998-01-07) abstract; figure 1</p> <p style="text-align: center;">---</p> | <p>13</p> |
| A | <p>US 5 584 095 A (REDDING G K ET AL) 17 December 1996 (1996-12-17) abstract column 5, line 41 -column 6, line 14 figures 1,2</p> <p style="text-align: center;">-----</p> | <p>19,27,33</p> |

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. Jonal Application No

PCT/CA 00/00018

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
|---|---|---------------------|--|--|
| FR 1094603 | A | 23-05-1955 | NONE | |
| US 2300266 | A | 27-10-1942 | NONE | |
| WO 9516382 | A | 22-06-1995 | US 5287591 A US 5363535 A EP 0734217 A JP 9506529 T | 22-02-1994 15-11-1994 02-10-1996 30-06-1997 |
| US 1937765 | A | 05-12-1933 | NONE | |
| US 4593429 | A | 10-06-1986 | AT 14974 T CA 1182613 A DE 3171910 D DK 272181 A,B, EP 0042723 A JP 1440279 C JP 57066728 A JP 62050140 B JP 1440322 C JP 61191329 A JP 62050141 B US 4826515 A US 4853011 A US 5160356 A | 15-09-1985 19-02-1985 26-09-1985 20-12-1981 30-12-1981 30-05-1988 23-04-1982 22-10-1987 30-05-1988 26-08-1986 22-10-1987 02-05-1989 01-08-1989 03-11-1992 |
| US 2267764 | A | 30-12-1941 | BE 432737 A BE 432738 A CH 214592 A CH 214882 A DE 757419 C DE 925542 C FR 851680 A FR 851681 A GB 511532 A GB 511583 A NL 65001 C | 12-01-1940 12-01-1940 |
| EP 0839489 | A | 06-05-1998 | DE 29617292 U DE 19651020 A | 05-02-1998 09-04-1998 |
| US 2595752 | A | 06-05-1952 | NONE | |
| EP 0815788 | A | 07-01-1998 | IT MI961308 A | 29-12-1997 |
| US 5584095 | A | 17-12-1996 | US 5323510 A EP 0708613 A JP 9503398 T WO 9501748 A | 28-06-1994 01-05-1996 08-04-1997 19-01-1995 |

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